



# ***FIRST Science Team Mtg#4 (FST4)***

***Minutes of Meeting, held at ESTEC, Noordwijk, 18-19 October 1999***

## ***1. Welcome and meeting agenda***

All members of the FST were present, except as indicated:

Peter Barthel, Mission Scientist (PB) - (not present agenda points 11-15)  
José Cernicharo, Mission Scientist (JC)  
Pierre Encrenaz, Mission Scientist (PE)  
Thijs de Graauw, HIFI Principal Investigator (TdG)  
Matt Griffin, SPIRE Principal Investigator (MG)  
Paul Harvey, Mission Scientist (PH)  
Martin Harwit, Mission Scientist (MH)  
Thomas Paßvogel, FIRST/Planck Project (ThP) - (not present agenda points 13-15)  
Tom Phillips, HIFI Co-Principal Investigator (TP)  
Göran Pilbratt, Project Scientist (GP)  
Albrecht Poglitsch, PACS Principal Investigator (AP)  
Laurent Vigroux, SPIRE Co-Principal Investigator (LV)  
Christoffel Waelkens, PACS Co-Principal Investigator (CW)

The chairman (GP) welcomed everyone to this the 4th FST meeting (FST4). A draft agenda was circulated on 3 October 1999, an updated version was circulated on 12 October 1999 and proposed in the meeting (cf. **Appendix 1**). The meeting adopted the proposed agenda.

## ***2. FST3 minutes of meeting***

The draft FST3-MOM - without appendices - were circulated on 9 July 1999, the final slightly revised version - taking comments into account - was circulated by email and put on DMS on 16 July 1999. The associated FST3-MOM appendices were put on DMS on 12 July 1999. The meeting approved the FST3-MOM without comments.

## ***3. Actions status***

The current actions were listed (cf. **Appendix 2**). Actions FST2-A2 (done) and A3 (imminent), as well as FST3-A3 (considered done, although more detailed drawings are still expected) and A4 (reconfirmed in the meeting), were closed in the meeting at this point. FST3-A1, A2, A5, A6, A7, were to be addressed as, or as part of, points 5, 6, 7, 11, 12 on the current agenda and were, except for FST3-A2, closed later in the meeting.



## 4. Status reports on FIRST activities

### 4.1 FIRST/Planck Project

**ITT.** The current Invitation To Tender (ITT - for phases B/C/D) schedule has been revised. The procurement proposal will be presented to the IPC in January 2000, rather than in November 1999. The ITT is now planned to be issued summer 2000. The launch date - Q1 2007 - is not under discussion, the issue is how late phase B can start - spring/summer 2001 now foreseen - and still be compatible with this launch date.

The meeting found the late start of phase B worrying from an instrument development point of view; instrument interfaces and EMC are only examples of areas that need to be addressed.

**CSA.** A Canadian Space Agency (CSA) potential contribution to the ESA FIRST/Planck project is being discussed. Four areas of interest: X-band system downlink, Planck telescope (mirrors from CSI, Denmark), ground station for FIRST and Planck (Algonquin Park replacing Perth), and/or star trackers (STRs) for Planck. CSA's own preferences are the Planck telescope, and the X-band system. The next meeting with CSA will take place in November, a decision is to be taken later this year.

**Downlink.** The downlink baseline rate is confirmed as 100 kbps, in the ITT it will be 'mentioned' that 200 kbps is 'desired'.

**Telescope.** The 2 m reflector 'test article' has been completed. It should now be in Tennessee for cold testing, no results are available at this point in time, the tests should be completed by end October. A telescope 'peer review' will take place in San Diego on 17-19 November with a day each devoted to: materials & processes, optical & mechanical, and thermal & verification. The telescope design report has been distributed - no feedback has been received from the instrument groups. MG found it helpful; GP commented that Peter de Maagt had reported some apparent inconsistencies, however AP found it consistent, but initially it appeared that some numbers were inconsistent.

**Commonality Working Groups.** The current seven CWGs will be restructured into three 'new' WGs to be devoted to: alignment, contamination, and EMC.

**ISVRs.** Instrument Science Verification Reviews (ISVRs) are being conducted for both FIRST and Planck instruments. The SPIRE ISVR is performed in 'parts', it is ongoing since July, next section takes place on 6-7 December; the HIFI ISVR will take place on 29-30 November, and the PACS ISVR on 9-10 December.

**Cryostat interface update study.** PM1 will take place this week at DASA, Ottobrunn. The study is concerned with the PLM only, it was planned to be completed by end of this year, now - with a later issue of the ITT - it might be continued.

**Alternative cryostat study.** The Air Liquide 'alternative cryostat' study is now in phase II, it will be completed in March 2000.

### 4.2 FIRST Science Centre

The FSC complement is now being built up, the FSC Development Manager is Johannes Riedinger (JR), now still sharing his time between XMM and FSC; the FSC System Engineer is Stephane Veillat, ex-ISO, ex-Space Station, (almost) full-time on FSC since 1 October. In addition two contractors, ex-XMM, will come onboard in the new year; since some time we have Ana Heras (currently on maternity leave) and Peter Claes, while Jean-Jacques Mathieu is providing support.

The main activities are the definition (in connection with the ICCs, project, and ESOC) of the overall FIRST science ground segment, and the FSC contribution to it, as well as the ongoing FINDAS prototype evaluation and URD production.

A second ground segment 'recess' was held in VILSPA on 13-15 October, following the first one near Compiègne on 4-7 July. It was decided that a 'FIRST GS scenario concept' (provisional title) document is a



necessary - and urgent - high level document (as is a project document tree - which can only be provided by the project). The draft list of contents with assigned input providers is attached as **Appendix 3**. The schedule requires first inputs to be provided by 8 November, they will be bundled and circulated unedited by GP by 10 November, written comments are then due by 24 November, also to be bundled and circulated. The week of 13 December is reserved for an intensive 'editing' session by a subset of the authors. The stated goal was have the document agreed by 23 December, and 'signed off' by each party involved.

The FST agreed that such a document was indeed needed and urgent. MH and JC participated in the VILSPA meeting as 'community representatives' and MH stated he was impressed by the professionalism in VILSPA. The FST felt that before signing the document it should be briefed directly by the involved. It was proposed to invite the ICC managers and JR (FSCDM) to FST5 (then foreseen to take place in January 2000) for a presentation, to be followed by updating - if required - and 'signing off'.

The FIRST Ground Segment Advisory Group (FGSAG) will formally be put in place; its foreseen composition is:

Göran Pilbratt, Project Scientist (chairman)  
Pierre Estaria, FIRST/Planck Project  
John Dodsworth, ESOC  
Johannes Riedinger, FSC Development Manager  
Pjotr Roelfsema, HIFI ICC Manager  
Otto Bauer, PACS ICC Manager  
Trevor Dimbylow, SPIRE ICC Manager

A 'user representative' - one of the MSs - could be added, this will be decided in the next FST meeting; the MSs are asked to contemplate this issue.

### **4.3 HIFI**

TdG presented a handwritten version of the VGs attached as **Appendix 4**. Points emphasized included: model philosophy is being 'reconsidered', output by end October 1999; the HRS selection includes test activities in December 1999, then in SRON in January 2000, with the selection planned for Jan/Feb 2000; the PDR of the FPU will take place on 29 November 1999, followed by the ISVR on 30 November 1999; an alignment plan is under development, output foreseen by end November 1999; an LO system workshop will take place at UMass, Amherst, on 28-29 October 1999.

### **4.4 PACS**

AP's presentation is attached as **Appendix 5**. Points emphasized included: a filtering scheme has been established, filters will be provided by QMW, in exchange for support in BSM development; the FPU optics have been redesigned; the detector development is hampered by the current non-availability of working CREs.

Main worry of not having functional CREs is that the detector modules, currently being produced, cannot be properly characterised. A systematic - now established - approach to the CRE development is necessary, requiring a change in the TRP contract. Some early encouraging results from this approach are already available.

### **4.5 SPIRE**

MG's presentation is attached as **Appendix 6**. Points emphasized included: FPU PDR, successful, but many points raised; the He3 cooler is a potential single point failure, a report addressing this issue is due by end of 1999; warm electronics PDR phase 2 will take place 6-7 December 1999 in Rome; detector array selection, including PDR on selected option will take place in RAL on 31 January-2 February 2000; future schedule includes PDR phase 3 in March 2000 and the Detailed Design Review (to release CQM H/W for manufacture) in September 2000 in RAL.



AOTs are considered to be built from: observatory functions, spacecraft functions with parameters, instrument functions with parameters, instrument data configurations, and instrument command sequences. It would be very desirable (mandatory?) to harmonise the logic and terminology for AOTs across instruments.

The Canadian (CSA) participation in SPIRE (shutter) is yet to be decided upon by CSA. A short discussion regarding potential CSA contribution(s) to FIRST (and Planck) in general (HIFI LO, SPIRE shutter, ESA, and Planck) generated that statement that an 'offer' of a package deal to CSA in collaboration with PIs could be a way forward out of an apparent stalemate in the CSA decision making process.

## **5. Clarification FST3-A1: pointing issues**

ThP's presentation is attached as **Appendix 7**. Points discussed include: Re. scanning, directions should be allowed to be specified either in RA/DE or in spacecraft coordinates. The FIRST Satellite System Specification will be issued in an updated version by end 1999, it will either contain the pointing information, or an updated FIRST Scientific Pointing Modes document will be issued as well.

In this context HIFI input has been received, but the PACS and SPIRE inputs are still missing for the pointing simulations to be performed by the project.

## **6. Clarification FST3-A2: downlink**

This point needs further study; new deadline is 31 December 1999; it will be put on the agenda for FST5.

## **7. Clarification of FST3-A5: undersized secondary**

MG and AP made presentations (cf. **Appendices 8 and 9**) addressing the need of SPIRE and PACS to have the secondary undersized in the FIRST telescope. The fundamental problem is that if diffraction does not fall on cold sky (outside M2) but on the 'warm' environment outside M1 you would have to be much more careful, and employ large safety margins, in the instrument designs leading potentially/probably to even more loss of collecting area than the current undersizing of M2 causes. SPIRE will provide a 'half-page' report on request by HIFI. HIFI will produce a reaction.

**Action 1:** SPIRE to produce 'half-page' report addressing the need for the undersized secondary. **Actionee:** MG. **Deadline:** 30 November 1999.

In connection with this point the PACS focus position assessment was presented by AP (**Appendix 10**). The presented conclusion was that by using a fit to a 'random' (nominally a 5x5 square) raster, the position of the secondary can be determined to within 10  $\mu\text{m}$ . If a refocussing capability is implemented in the FIRST telescope, then PACS can measure the position of M2 with this accuracy.

## **8. Simultaneous instrument operation**

The various 'conceivable' modes of operation of an instrument include: prime, parallel, serendipitous, and partner modes, all of which would eventually have to be properly defined. For the purpose of the present discussion the prime mode is exactly that, a parallel mode is intended for an instrument operating in addition to the prime, a serendipitous mode is to be used when no prime instrument is assigned, while the partner mode is a PACS/SPIRE prime mode which can best be considered a 'logical' fourth prime instrument.

At present it is an open issue to what extent these modes will be implemented, and exactly what they would mean. The question is to what extent multi-instrument modes are valuable from a science return point of



view given the various restrictions imposed; including thermal, data rates, interference, etc. General points include:

- HIFI operation may preclude the operation of PACS and/or SPIRE (e.g. due to the LO signal)
- SPIRE always needs its internal cooler; to recharge the cooler is an ‘thermal investment’ for which we want to maximise return => do not turn SPIRE off when it could observe.
- The above argument also holds for channels 6 and 7 for HIFI
- HIFI should be not switched on/off frequently, its thermal timescale is a few hours

In the ensuing discussion the meeting quickly agreed that assigning ‘large’ blocks of time per instrument was likely to be the ‘standard’ mode of operation, and that the partner mode was likely to have the highest priority of any additional mode. However, at this point time the FST would not want to ‘sanction’ an ‘only-one-instrument-at-any-one-time’ policy.

MG: Happy to see large chunks of time, perhaps a week rather than e.g. 48 hours at a time; but would not want to cast this in stone at an early time. AP: Partner mode highest priority wrt all ‘combined’ modes, i.e. higher than ‘parallel’ or ‘serendipitous’ modes. Partner mode can be clearly assessed wrt two prime modes in sequence. How do you assess the cost-to-benefit- ratio for parallel and serendipitous modes? TdG: Confession, don’t overestimate the productivity of parallel/serendipitous modes, I was wrong arguing against dedicated instrument orbits for ISO.

## ***9. Criteria for replacement of FMs with FSs***

For ISO there existed a (very short) document outlining what criteria should be ‘fulfilled’ in order to force the replacement of an instrument with its flight spare. The criteria were quantitative of the form ‘if an instrument FM performance falls a factor  $x$  below the (previously) measured performance ... then it should be replaced by the FS’.

We will need a similar (in function, but not necessarily in form) document for FIRST. For the FIRST instrument we have the (cryogenic) FPUs inside the PLM, and (‘warm’ electronics) that sit in the SVM. The AO requires FSs to be supplied for the cryogenic FPUs, and ‘kits’ for the ‘warm’ electronics. There is resistance in the instrument teams to provide ‘complete’ FSs, mainly because of funding pressure, but also because it is felt that a FS will not have the same ‘quality’ (especially with respect to characterisation) as the FM.

There is in fact also the ‘opposite’ (to the ISO) argument; what if the FS performance is measured to be a factor  $x$  better than FM - should this force replacement? LV: difficult to anticipate for cryogenic part, but possibly for warm electronics.

It was felt in the FST (after an initial remark by TP) that in real life it will be impossible to anticipate all possible failure modes, and thus that there is a need to invoke a group to make a decision in ‘real time’ on a case-by-case basis. It was concluded that ‘theory should not be mixed up with implementation’, there is a need for a document to address Go-NoGo criteria ‘philosophy’, but it should not address how to deal with the ‘repair’ problem.

**Action 2:** Draft Go-NoGo criteria ‘philosophy’. **Actionee:** GP. **Deadline:** Next FST meeting.

## ***10. Astro-F/IRIS***

(This point was actually dealt with before point 9.) Astro-F /IRIS (IR Imaging Surveyor) is a Japanese cryogenic mission with a 70 cm diameter telescope operating at 6 K, and two instruments: the Far-IR Surveyor (FIS) and the IR Camera (IRC). It is currently scheduled to be launched in February 2003 (cf. <http://koala.as->



tro.isas.ac.jp/Astro-F/index-e.html). A major scientific objective will be to perform an all-sky survey, at 60 and 170  $\mu\text{m}$ , with a sensitivity two orders of magnitude better than IRAS.

There are currently discussions going on between ESA, in the form of Martin Kessler, and the Japanese, with the goal of establishing whether a collaboration could be set up. Japan needs an additional ground station, preferably at high geographical latitude.

## 11. FIRST workshop

The objective of the meeting is to connect to the astronomical ‘community at large’ i.e. not ‘only’ to the ‘traditional’ IR/submm community. The ‘top-level’ issue we would like to address is: How should the 3 years of available FIRST observatory time be best spent in order to maximise the science return? An important part of this assessment is the balance between ‘key’ programmes and ‘other’ programmes.

A possible method to address this question could be to identify science areas, prioritise, and carve up the three years, just as an exercise, to be performed in groups. In any case we need to invite ‘good’ speakers from outside the FIR/submm community.

The workshop should take place in the week of 11 December 2000, likely leaving the Monday free for travelling, starting Tuesday morning and going on for 4 days, thus 12-15 December 2000. JC has been working on a proposal to hold this conference in Hotel Beatriz, in Toledo, Spain. A possible title could be; ‘The promise of FIRST - a science workshop’. The practical arrangements will need confirmation ‘soon’.

**Action 3:** Draft the FIRST workshop 1st mailing. **Actionee:** GP. **Deadline:** 30 November 1999.

## 12. FIRST and Planck synergies

This point was introduced by MH (cf. **Appendix 11**). The Planck PS Jan Tauber was then invited to make a presentation (cf. **Appendix 12**).

It is clear that an ‘early’ point source catalog from Planck could be of interest for FIRST. Such a list could be (made) available  $\sim 6$  months after completion of 1st all-sky survey, i.e. after 6 (transfer to L2) + 6 (1st survey) + 6 (production) = 18 months = 1 1/2 yrs after the launch of FIRST and Planck, or seen from a FIRST perspective, after the first of the 3 years of routine operations.

The production of such an early point source catalog would require additional (wrt initially foreseen) DPC resources, and would probably have a lower flux level limit of order a few  $\times 100$  mJy. If the early point source catalog is produced, it is likely that it will be ‘public’, rather than being made available to FIRST only. There are also other aspects of Planck data that are of interest for FIRST users, but it was felt to be ‘normal work’. As an example, FIRST should benefit from Planck by improved calibration.

Planck interest in FIRST observations include e.g.: follow up on sources, number counts in ‘high’ background areas, hyperluminous/lensed sources, clusters of Planck sources, and the study in detail a random sample of Planck sources by FIRST. Thus, Planck can benefit (in its ‘prime’ cosmology science objectives) by FIRST ‘foreground’ observations, but there are also ‘secondary’, the non-CMB, science objectives.

It was decided that the next step would be to have a joint FST/PST session. The currently planned January 2000 date for FST5 was found to be too early; it was decided to move FST5 to March 2000 (cf. point 14 below) with the hope that the PST could choose a date for its March 2000 meeting so that there is overlap.

**Survey mission scientist.** In this context LV reminded the FST of the AWG recommendation that a MS with special responsibility for surveys should be addressed. It was not clear to the FST whether the AWG wanted to augment the number of MSs, or whether it was urging to ‘assign’ this responsibility properly so that that it could not ‘fall between chairs’. MH/TdG: Not really necessary to augment MSs. CW: AWG may insist that another MS, if appointed, should be a solar system specialist.



It was decided that we should 'map' responsibilities among the present MSs, and in parallel GP should approach the AWG to find out what it really wants/meant.

## **13. Written material on FIRST science**

GP pointed out that there is very little up-to-date written material available on FIRST science. This is a problem in several ways, e.g. for the Web, and it needs to be addressed. (In parenthesis the deplorable situation with respect to FIRST (and Planck) PR was commented upon negatively - something must happen here.)

It was decided to produce, as a starting point, four 'write-ups' primarily intended for the Web. They should be aimed at a 'general community astronomer' (thus not a FIR/submm specialist), be written in an attractive 'interest-generating' style, they should be brief but still 'long enough' to offer serious information, and contain visually attractive (and informative!) illustrations. It was agreed that the following people would take the lead in the respective area noted:

- Matt Griffin: Galaxy formation and evolution
- Paul Harvey: Star formation
- Thijs de Graauw: The molecular universe
- Pierre Encrenaz: Solar system science

The deadline for the 1st drafts are by the end of November 1999. The entire FST will be given the opportunity to comment before the material is eventually made public on the Web. GP also intends to use this material - among other material - as input for poster and 'leaflet' production, which is 'ongoing' - whatever that means. GP also asked for and got the permission to make the **science objectives parts of the instrument proposals publicly available**.

**Action 4:** Produce first draft of FIRST science Web 'write-ups. **Actionee:** MG/PH/TdG/PE. **Deadline:** 30 November 1999.

## **14. Date of next two meetings**

It was planned to hold **FST5** on 24-25 January 2000, but it was decided to postpone it to **7-8 March 2000** with the intention to create an overlap with a Planck ST meeting. **FST6** is planned for **6-7 July 2000**. FST5 will be held in ESTEC, FST6 location is currently TBD.

**Action 5:** Look into whether (some) future FST meetings could be held outside ESTEC. **Actionee:** GP. **Deadline:** Next FST meeting.

## **15. AOB**

### **15.1 European Space and Ground Astronomy Coordination group**

GP reported on behalf of PB that the second 'European Space and Ground Astronomy Coordination' group meeting will take place sometime (TBD) in January 2000. The idea is to establish a 'super-TAC' on top of ESO, La Palma, ESA, to ensure the most efficient usage of available (space and ground!) observatory resources.

### **15.2 Groningen workshop**

GP reported on behalf of PB that an international workshop, 'The FIR and submm spectral energy distributions of active and starburst galaxies' will be held in Groningen, The Netherlands, 27-29 April 2000.

**Action 6:** Distribute PB's email announcement to all members of the FST. **Actionee:** GP. **Deadline:** ASAP.



## ***List of Appendices:***

- Appendix 1:** Proposed agenda
- Appendix 2:** Actions status
- Appendix 3:** 'FIRST GS scenario concept' document list of contents
- Appendix 4:** HIFI status presentation by Thijs de Graauw
- Appendix 5:** PACS presentation by Albrecht Poglitsch
- Appendix 6:** SPIRE presentation by Matt Griffin
- Appendix 7:** Pointing issues clarification presentation by Thomas Paßvogel
- Appendix 8:** SPIRE undersized secondary need presentation by Matt Griffin
- Appendix 9:** PACS undersized secondary need presentation by Albrecht Poglitsch
- Appendix 10:** PACS secondary position measurement presentation by Albrecht Poglitsch
- Appendix 11:** Introduction to FIRST and Planck synergy by Martin Harwit
- Appendix 12:** Planck presentation by Jan Tauber

## ***List of Actions:***

- FST3-A2:** Assess all (technical, financial, station availability, etc.) implications of doubling the downlink time from the nominal 2 hours. **Actionee:** ThP. **Deadline:** 30 September 1999. **New deadline:** 31 December 1999.
  
- FST4-A1:** SPIRE to produce 'half-page' report addressing the need for the undersized secondary. **Actionee:** MG. **Deadline:** 30 November 1999.
- FST4-A2:** Draft Go-NoGo criteria 'philosophy'. **Actionee:** GP. **Deadline:** Next FST meeting.
- FST4-A3:** Draft the FIRST workshop 1st mailing. **Actionee:** GP. **Deadline:** 30 November 1999.
- FST4-A4:** Produce first draft of FIRST science Web 'write-ups. **Actionee:** MG/PH/TdG/PE. **Deadline:** 30 November 1999.
- FST4-A5:** Look into whether (some) future FST meetings could be held outside ESTEC. **Actionee:** GP. **Deadline:** Next FST meeting.
- FST4-A6:** Distribute PB's email announcement to all members of the FST. **Actionee:** GP. **Deadline:** ASAP.